

Bycatch of the pelagic ray *Dasyatis violacea* in Uruguayan longline fisheries and aspects of distribution in the southwestern Atlantic*

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SUMMARY: The presence of the pelagic ray *Dasyatis violacea* (Bonaparte, 1832) in Uruguayan waters has been monitored since April 1998, the beginning of the National Observer Programme on board the Uruguayan tuna fleet (PNOFA). These are the first records of these species for the South Atlantic off Uruguay. Its distribution within the area is analysed, based on 13 trips made from April 1998 to September 2001 from 26 to 37°S. Five hundred and twenty five specimens were caught during this period. The presence of the species appears to be closely associated with the highest values of surface water temperature, with CPUE being relatively low below 20°C. The southern border of its distribution is around 36°S. *Dasyatis violacea* is part of a well-defined warm water fauna that reaches Uruguayan and northern Argentinean waters following warm subtropical waters. The incidental capture of *D. violacea* in the area reaches significant levels; the species is always discarded. We suggest that this bycatch is important and should be monitored from a conservation point of view.

Key words: longline fisheries, bycatch, *Dasyatis violacea*, southwestern Atlantic.

RESUMEN: CAPTURA INCIDENTAL DE LA RAYA PELÁGICA *DASYATIS VIOLOACEA* POR LA FLOTA PALANGRERA URUGUAYA Y ASPECTOS DE SU DISTRIBUCIÓN EN EL ATLÁNTICO SUDOCCIDENTAL. – La presencia de la raya pelágica *Dasyatis violacea* (Bonaparte, 1832) en aguas uruguayas ha sido detectada desde el comienzo del Programa Nacional de Observadores a bordo de la Flota Atunera Uruguaya (PNOFA) en abril de 1998. Este es el primer informe sobre esta especie para el Atlántico Sur, frente a las costas de Uruguay. Se analiza su distribución dentro del área, sobre la base de 13 viajes realizados entre abril de 1998 y septiembre de 2001, entre los 26° y 37° S. Durante dicho período se capturaron quinientos veinticinco ejemplares. La presencia de esta especie parecería estar estrechamente relacionada con los valores más altos de temperatura superficial del agua, con una CPUÉ relativamente baja por debajo de los 20° C. La frontera sur de distribución de la especie estaría alrededor de los 36° S. *Dasyatis violacea* integra una fauna de agua templada bien determinada, que alcanza las aguas uruguayas y del norte de Argentina, siguiendo corrientes subtropicales templadas. La captura incidental de *D. violacea* en dicha área alcanza cifras significativas. Esta especie es siempre descartada. Sugrimos que esta captura fortuita es importante y debería ser analizada, a efectos de generar medidas que permitan su conservación.

Palabras clave: pesquería de palangre, captura fortuita, *Dasyatis violacea*, Atlántico sudoccidental.

INTRODUCTION

Dasyatis violacea is widely distributed in the tropical and subtropical areas of the Pacific,

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Atlantic and Indian Oceans. It is the only currently known pelagic species in the family Dasyatidae. Knowledge about its distribution has improved with the increase in longline fisheries in several areas (Scott and Tibbo, 1968; Wilson and Becket, 1970; Nishida and Nakaya, 1990; Menni

TABLE 1. – Dates of capture of *Dasyatis violacea*. Effort is number of hooks and CPUE is number of individuals per 1000 hooks. Mean temperature (°C) refers to surface water.

	Date	Nº of sets	Effort	Mean tem. (°C)	Number of individuals	Cpue
1998	9-27/APR	15	14,850	21.94	91	6.13
	13/JUL-14/AUG	26	25,045	18.73	19	0.76
	18-27/OCT	7	6,160	19.4	5	0.81
	30/OCT-10/NOV	11	12,000	18.97	22	1.83
1999	2-13/APR	11	12,470	23.18	143	11.47
	2-14/JUL	11	11,530	19.13	1	0.09
2000	21/AUG-29/OCT	49	42,390	19.14	228	5.38
	17/SEPT-1/OCT	10	8,300	18.5	3	0.36
	17-29/SEPT	7	6,450	19.43	2	0.31
2001	18-23/NOV	5	4,100	19.1	3	0.73
	4-16/JUN	12	10,220	21.18	5	0.49
	23/JUL-6/AUG	9	10,160	19.57	2	0.20
	8-25/SEPT	12	12,910	20.89	1	0.08

et al., 1995; Menni and Stehmann, 2000; Mollet, 2002).

In Uruguay the tuna longline fishery started in 1969 with a single vessel which operated until 1974 (Nion, 1999). In 1981, the fishery was reactivated with a tuna fleet (Ríos et al., 1986) operating through to the present time. Two different fishing operations occurred during this period. From 1981 to 1992, vessels with Japanese skippers and gear targeted mainly swordfish (*Xiphias gladius*), bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) that were landed frozen (Ríos et al., 1986). From 1992 to the present, vessels with American-type monofilament longline gear targeted mainly swordfish that was landed fresh (Domingo et al., 2001). During the latter period, fishing permits for experimental fishing were granted to two foreign vessels which operated from 1993 to 1996, capturing swordfish with a monofilament gear different from that used by the fleet (Marín et al., 1998).

The *D. violacea*, was reported from the Atlantic by Bigelow and Schroeder (1962), and from the Gulf of Mexico by Branstetter and McEachran (1983). Off Brazil, *D. violacea* has been recorded from between 20°53' and 21°36'S and between 37°16' and 46°44'W (Sadowsky and Amorim, 1977; Sadowsky et al., 1986). Menni et al. (1995) reported a female from 8°24'S and 31°33'W off northeastern Brazil. Subsequently, many individuals of *D. violacea* were captured off northeastern Brazil within the area from 2°30' to 8°30'S and from 30°30' to 32°30'W, over bottom depths well below 4000 m. Temperatures at the surface for these capture locations ranged between 26.5 and 28.5°C (mean 27.75°C, N= 14), but the calculated temperatures at the hook depth where *D. violacea* was caught

ranged from 13.4 to 27.0°C (mean 17.34°C, N= 8) (Menni and Stehmann, 2000).

This work reports the presence of *D. violacea* in Uruguayan waters and analyses its distribution and share in the total and discarded capture.

MATERIAL AND METHODS

Specimens and data were obtained from 13 trips carried out from April 1998 to September 2001 (Table 1) by the National Observer Programme on board the Uruguayan Tuna Fleet of the Dirección Nacional de Recursos Acuáticos (formerly Instituto Nacional de Pesca). This programme was implemented in 1998, and one of its main objectives is to record the composition and quantity of the capture. Sampling was carried out on longliners targeting swordfish, which operate within the Uruguayan Economic Exclusive Zone (EEZ) and adjacent international waters, between 26 and 37°S and 36 and 55°W (Fig. 1). The fleet used an American-type

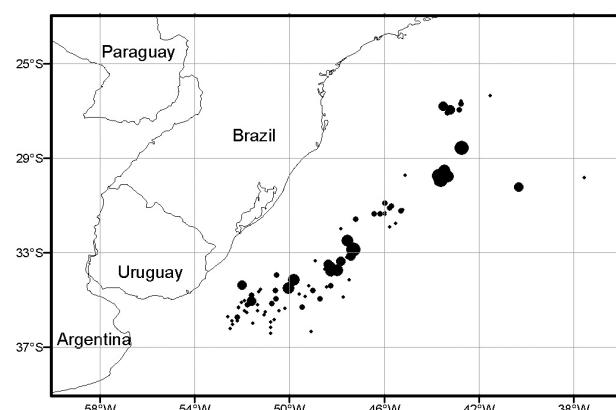


FIG. 1. – *Dasyatis. violacea* capture areas.

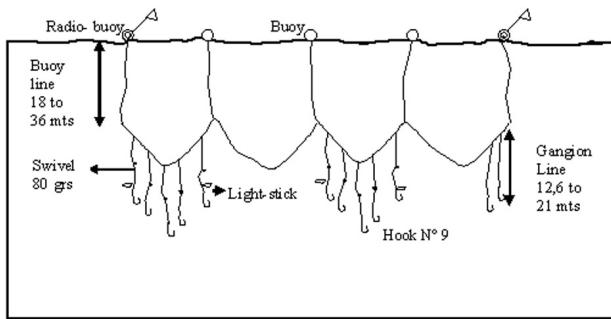


FIG. 2. – Gear used by Uruguayan long line vessels

monofilament longline (Fig. 2). The total captures were classified as capture, catch, discard (bycatch and release) (Hall, 1996) and lost catch (Domingo, 2002). The capture per unit effort (CPUE) was calculated as the number of individuals per 1000 hooks. The discard modality makes sex determination rather difficult and data in this connection may be biased. Therefore, sex-ratio was not included in this study. Eight specimens were measured (Table

2) and deposited with the fish collection of the Facultad de Ciencias de la Universidad de la República Oriental del Uruguay (ZVC-P No. 4566 to ZVC-P 4573). Measurements were taken according to Bigelow and Schroeder (1962), Hubbs and Ishiyama (1968) and Stehmann (1995). No morphometrics were taken for the rest of the specimens captured.

RESULTS

A total of 525 individuals of *D. violacea* were captured during the analysed period: 137 in 1998, 372 in 1999, 8 in 2000 and 8 in 2001 (Table 1).

The morphometrics of the 8 specimens collected agree with the available information provided by Scott and Tibo (1968), Wilson and Beckett (1970), Nakaya (1982), Lamilla and Melendez (1989), Nishida and Nakaya (1990) and Menni *et al.* (1995) (Table 2).

TABLE 2. – Morphometrics of specimens of *Dasyatis violacea* deposited with the fish collection of the Facultad de Ciencias, Uruguay. Measurements as percent of disc width.

Measurement	Male 1	Male 2	Male 3	Male 4	Male 5	Female 6	Male 7	Male 8
Total length (mm)	940	970	920	994	1146	956	990	860
Disc width (mm)	450	240	458	434	460	568	446	378
Disc length	75.56	133.34	78.6	75.58	78.69	78.52	81.61	76.19
Anterior Projection	34.23	62.92	38.65	35.71	38.04	36.44	30.94	33.07
Snout tip to origin cloaca	62.89	111.67	68.56	63.82	67.39	72.18	68.61	–
Snout tip to pelvic fin	63.12	108.34	67.25	61.75	64.78	69.37	66.59	64.55
Preorbital length	11.23	20.83	13.75	12.79	12.39	13.2	14.12	13.76
Prenasal length	10.23	17.5	11.35	9.91	10.22	10.03	9.64	9.79
Preoral length	14.45	22.08	14.52	13.71	14.56	13.53	14.12	13.76
Prespiracular length	16.89	30.42	19	17.28	17.39	16.55	18.83	16.67
Eye diameter	4	6.46	3.6	3.34	3.26	3.08	3.47	3.31
Interorbital width	15.12	25.21	14.3	14.17	15.33	14.26	17.71	13.89
Spiracle length	6.12	8.54	5.24	5.41	5.33	6.16	5.83	4.76
Interspiracular width	18	32.5	18.56	17.28	17.39	16.2	19.17	16.14
Nasal curtain width	12.23	20.42	11.57	11.75	12.39	10.74	12.11	10.98
Nasal curtain length	4.78	9.37	3.71	3.92	4.13	3.17	4.26	3.44
Internarial width	9.89	17.92	9.5	10.14	9.78	8.8	10.2	8.73
Mouth width	13.12	22.08	12.66	12.9	13.48	12.76	13.45	13.09
Snout tip to first gill opening	24.67	41.67	24.89	23.04	24.56	23.06	25.34	21.43
Snout to fifth gill opening	36	62.92	35.81	32.95	35.22	34.68	37.22	32.54
Interspace first gill slits	19.34	33.54	18.12	18.89	19.02	19.01	19.17	18.52
Interspace fifth gill slits	12.67	21.25	13.1	12.21	12.39	12.67	13.45	13.49
Branchial basket length	11.78	20	11.13	10.83	11.3	12.15	12.56	10.85
Pectoral fin inner margin	11.34	24.17	10.15	11.29	11.3	11.09	11.21	8.46
Pectoral fin anterior margin	14.23	24.17	13.32	14.86	12.28	10.21	11.55	10.85
Posterior margin of pectoral fin	7.89	15.62	8.84	8.98	8.26	10.39	8.74	8.2
Pelvic fin base	7.23	14.58	8.08	5.99	8.15	8.27	8.74	–
Pelvic fin Inner margin.	4.23	5.84	4.58	4.6	4.56	10.56	4.48	3.17
Tail width	6.56	11.67	6	5.99	5.43	5.98	5.83	5.82
Tail height	4	7.5	4.15	3.69	4.13	4.05	3.59	3.97
Distance from origin of cloaca to spine origin	34	60.42	33.84	30.64	35.22	32.75	35.87	–
Spine length	27.56	54.17	–	28.11	–	25.18	24.66	29.1
Clasper length	24	45.84	24.45	23.96	24.35	–	25.11	–
Clasper external length	10.45	19.58	12.88	11.4	10.87	–	10.76	13.76
Number of oral papillae	4-6	6-8	5-5	5-6	4-5	6-7	5-6	7-5
Supracaudal membrane					Absent			
Infracaudal membrane					Weakly developed, continues along the spine, 1.5 mm width			

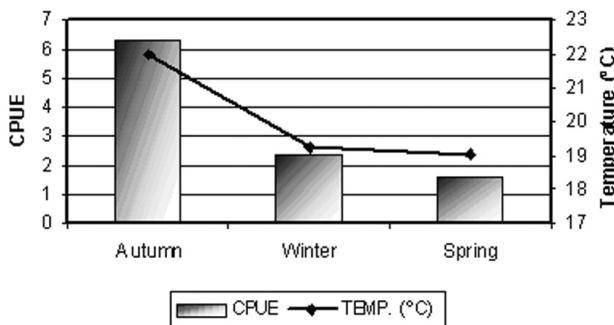


FIG. 3. – *Dasyatis violacea*. Seasonal variation in capture.

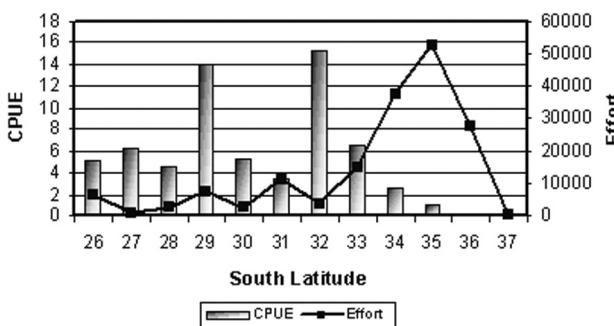


FIG. 4. – *Dasyatis violacea*. CPUE and effort according increasing South latitude

Longline sets were made at depths ranging from 40 to 60 m, over bottom depths ranging from 750 to 5000 m. *D. violacea* were captured in 51% of the sets, of which 2% were made at depths below 1000 m, 10% between 1000 and 2000 m, 15% between 2000 and 3000 m, and 73% below 3000 m.

CPUE values reached maximum levels (6.1 and 11.5 individuals/1000 hooks) in April 1998 and 1999 respectively, and minimum levels (0.09 and 0.08 individuals/1000 hooks) in July 1999 and September 2001 (Table 1). The highest seasonal accumulated CPUE values were observed in fall, with 6.4 specimens/1000 hooks, and the lowest were

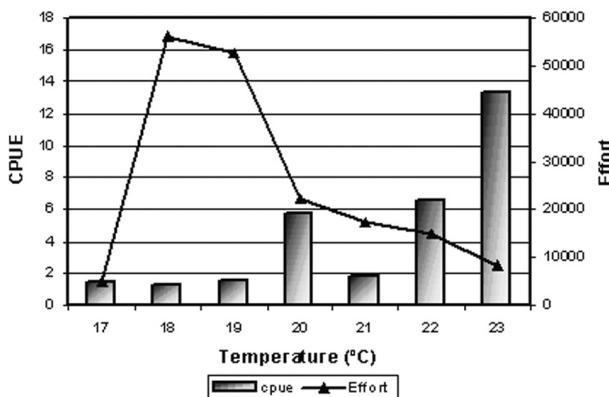


FIG. 5. – *Dasyatis violacea*. CPUE and effort as related to Temperature

recorded in spring, with 1.6 specimens/1000 hooks. Likewise, the maximum (22.1°C) and minimum (19.1°C) mean water temperatures were observed in fall and spring respectively (Fig. 3). The highest CPUE values by latitude were observed between 29 and 32°S, while the lower values were observed between 34 and 37°S, in spite of increasing effort (Fig. 4).

Considering the range of mean surface water temperature, values of CPUE were higher between 20 and 23°C and lower between 17 and 19°C (Fig. 5).

For the period 1998-2001, the *D. violacea* represented 3.1% of the observed capture, 9.3% of the discarded capture and 0.1% of the lost capture.

DISCUSSION

This is the first record of *D. violacea* in Uruguay ocean waters. *Dasyatis violacea* occurs almost worldwide at tropical, subtropical and temperate latitudes. Its migratory patterns and reproduction cycles are not known. However, it has been suggested that in the eastern Pacific females give birth in winter in the warmer waters off the coast of Central America and then migrate to higher latitudes (Mollet, 2002). Mollet *et al.*, 2002, suggest that the gestation period is short and there may be up to two litters per year.

Dasyatis violacea is captured off southeastern and southern Brazil between 20 and 33°S and between 40 and 50°W, together with a typical pelagic longline fauna at about 200 m depth (Sadowsky and Amorim, 1977; Sadowsky *et al.*, 1986).

Menni and Stehmann (2000) reported numerous specimens obtained off northeastern Brazil from 2°30' to 8°30'S and from 30°30' to 32°30'W. Bottom depths at all these stations were well below 4000 m. In contrast, *D. violacea* was not captured towards the northwest, where there are large submarine banks and the waters are more shallow.

Marín *et al.* (1998) reported the presence of *Dasyatis sp.* in the Atlantic Ocean. From the data available with regard to the fishing area, gear, target species and accompanying fauna, it may be assumed that the species reported was *D. violacea*. In the area under study *D. violacea* apparently forms part of the epipelagic fauna. Off Uruguay from 26 to 37°S, with hooks set between 40 and 60 m, *D. violacea* was captured in 51% of the sets.

Marín *et al.* (1998) reported that the highest proportion of captures (10.1% of the total) were in

oceanic waters over 200 miles from the coast. The lowest proportion (0.4 to 0.7%) was reported from the Uruguayan EEZ over bottoms less than 600 m deep.

Considering the distribution of *D. violacea* according to latitude, our results show that a sharp decrease in CPUE is observed below 33°S in spite of increasing effort. However, there are CPUE peaks at 29°S and 32°S which are apparently not related to latitude but to local variations in surface water temperature.

In our study, an increase in the CPUE was observed with increasing surface water temperature, with CPUE being relatively low below 20°C (Fig. 5). Captures of *D. violacea* were higher with increased autumn temperatures, and decreased in winter and spring with lower temperatures (Fig. 3). This trend was supported by the fact that captures increased with higher surface water temperatures despite lower fishing effort. This pattern, also observed in sharks of the genus *Sphyrna*, is relatively common in subtropical chondrichthyan and osteichthyan species. Briggs (1974) suggested that the latitude of the Rio de la Plata mouth was the probable southern limit of the warm temperate fauna. Three chondrichthyan families and twenty teleostean families (tropical and subtropical) do not occur beyond this border (Menni 1981).

Dasyatis violacea has a wide distribution in the south western Atlantic, being more abundant at latitudes below 34°S. Data collected by Mollet (2002), together with information from this study suggests that this species occurs throughout the Atlantic Ocean.

Though wholly discarded, the species is part of the bycatch of the Uruguayan pelagic fishery. The hooks are removed by smashing the fish against the rail because the crew are concerned about injury from the ray's spine, which can result in them being off work for a few days. Consequently, most individuals are discarded with serious mouth and/or jaw damage and probably have a low chance of survival.

CPUE values decrease from autumn to spring, following decreasing mean surface water temperatures. Considering the CPUE values obtained and a 100% discard with low survival, it is obvious that more attention should be given to the capture of this species by the longline fleets.

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